Adjustment Strategies for Managing Unanticipated Changes in Software Development Processes

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Agenda

- Adaptability in Software Engineering
- Software Engineering from the systems perspective
- Evolutionary model for adaptable design
- Related Research
- Summary and further research

Adaptability in Software Engineering (SE)

- Basic definition:
  - Adaptable is a system that can adapt itself fast and efficient to changing conditions.
  - System defines change requirement and alternatives

- Proceeding models for SE:
  - Search for adaptable models
  - Main goal: Generation of adaptable processes

- Adaptable SE process:
  - Requirement: "flexible" Software development
  - Property: project and task planning

Adaptability of Software Engineering Processes

- Build-time:
  - Anticipation of adaptability
  - Process alternatives from start
  - Parameters to adjust
  - Typically SE proceeding models

- Run-time:
  - Anticipated and not anticipated alternatives
  - Surrounding conditions influence task fulfillment and process design (McKinley et al. 2004)
  - Typically deviations from SE proceeding models

Efficient product development is the main goal of the process
**Agenda**

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**The software development process**

Phase 1
Phase 2
Phase 3
Phase...

SE Model

Specification
Developing
Implementation
Release

SE Process

Adaption request

seen from the viewpoint of system theory.

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**Three levels of influence ...**

**Elements of the system**
- Replacement of an element
- Resources, products, phases

**Structural change**
- Connection topology
- Relations between the elements

**Distribution of the elements**
- Distribution (degree and kind)
- Migration of elements (resources)

...represent aspects to be seen separately or together.

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Basic functions to realize adaptable SE Processes

- Context management
  - Environment turbulences
  - Significant changes
  - Monitoring and alerting

- Management of alternatives
  - Generation of and choice between alternative options
  - Evaluation of alternatives

- Management of adaptation activities
  - Realisation of structural changes
  - Migration and should-be-status

- Context and structural properties drive decisions and adaptation activities

PEPMAD - Potsdam Evolutionary Process Model for Adaptable Design

- Input
- Output
- Criteria
- Recommended actions

Adaptability is a continuous organizational task!

Basic functions of PEPMAD

- Run-time information (context)
  - As-is - information from environment and resources
  - Gathering of the actual status

- Management of alternatives
  - Generation of recommendations
  - E.g. weighting of tasks

- Continuity
  - "Evolutionary"
  - Permanent diagnosis and running of the model

The Should-be-state is measured against the criteria of adaptability

PEPMAD - how it really works!

- Distribution of elements
- distributed single
- Situation-based questionnaire
- weightening of criteria
- Recommendations

- Communication analysis
- KMDL
- Decision-area
- Structural topology

- Context Management
- Monitoring / Loop structure
- Reconfiguration Management

Andresen, Gronau, Levina 2008
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Related Research

Self organization

- Biology, swarm intelligence
- Complexity management and change (Bohner, 2007)

Software engineering

- Self-adaptive software
- Communication infrastructures and mobile applications (Gheis, 2008)

Autonomic Computing

- Self management of IT systems
- MAPE (monitor-analyze-plan-execute) model
- Work of Kephart/Chess (Kephart, Chess 2003)

Summary

Adaptability of processes

- Separation between structure and process
- Three-dimensional structural classification

Potsdam Evolutionary Process Model for Adaptive Design

- Integration of structural decisions in analysis
- Combined management summary

Outlook and further work

Prozess viewpoint

- Distributed decision-making
- Local vs. global Optimum

PEPMAD

- Higher degree of integration
- Integration of SE proceeding models in recommendations

Application in practice

- Analysis of further USE-Cases
- Establishing of an analysis and consulting approach

- The integration of product line concepts and maturity models are possible future tasks.
References